

Example 14: Determine the total energy possessed by the Moon as it orbits the Earth.

$$E_T = E_k + E_p$$

$$= \frac{1}{2}mv^2 + -\frac{GMm}{r}$$

→ must find orbital speed

$$\rightarrow \text{use } F_c = F_g$$

$$\frac{mv^2}{r} = \frac{GMm}{r^2}$$

$$v^2 = \frac{GM}{r} \Rightarrow \text{sub. into energy equation}$$

$$\text{So } E_T = \frac{1}{2}m\left[\frac{GM}{r}\right] + -\frac{GMm}{r}$$

$$= -\frac{1}{2}\frac{GMm}{r}$$

$$= -\frac{.5(6.67 \times 10^{-11})(5.98 \times 10^{24})(7.35 \times 10^{22})}{3.84 \times 10^8}$$

$$\boxed{E_T = -3.8 \times 10^{28} \text{ J}}$$